

## Claims

1. A method for rendering an image with high resolution lighting characteristics, comprising:

generating a texture map associated with the image, the texture map defined by texels;

calculating a value representing a lighting characteristic for each of the texels;

storing the value;

associating a coordinate space of the texture map with a display screen coordinate space; and

rendering the image on a display screen using the stored value.

2. The method of claim 1, wherein the method operation of calculating a value representing a lighting characteristic for each of the texels includes,

determining visibility from a point associated with one of the texels; and

determining a distribution of an incoming light ray.

3. The method of claim 2, wherein an occlusion function is applied to determine the visibility and ray tracing is applied to determine the distribution of incoming light.

4. The method of claim 1, wherein the method operation of calculating a value representing a lighting characteristic for each of the texels includes,

defining an image associated with a first resolution; and

applying a basis function to determine the value.

5. The method of claim 4, wherein the value is represented by multiple coefficients.

6. The method of claim 4, wherein the image on the display screen is associated with a second resolution, the second resolution being less than the first resolution.

7. The method of claim 4, wherein the method operation of applying a basis function to determine the value includes,

executing a transfer function to yield the value.

8. A method for incorporating lighting characteristics of an image of an object into a texture map, comprising:

defining a texture map associated with the image;

determining a lighting characteristic associated with a texel of the texture map;

and

associating the texel with the lighting characteristic.

9. The method of claim 8, wherein the method operation of determining a lighting characteristic associated with a texel of the texture map includes,

identifying a point on the image; and

calculating a coefficient representing the lighting characteristic through the application of a basis function.

10. The method of claim 8, further comprising:  
rendering the image on a display screen, wherein the lighting characteristic defines shadows associated with the image being displayed.

11. The method of claim 10, wherein the image on the display screen is associated with a first resolution and the image is associated with a second resolution, wherein the first resolution is less than the second resolution.

12. The method of claim 8, wherein the lighting characteristic includes both self shadowing and self interreflection components.

13. The method of claim 8, wherein the method operation of determining a lighting characteristic associated with a texel of the texture map includes, calculating the lighting characteristic in a manner such that an intensity of the lighting characteristic does not fluctuate when a light source is moved.

14. The method of claim 8, wherein the lighting characteristic is derived from a transfer function.

15. The method of claim 14, wherein the transfer function calculates a value representing reflected light from a surface of the image.

16. A method for rendering an image, comprising:  
defining a texture map associated with the image;

associating a value corresponding to a multi-directional signal with a texel of the texture map;

determining an intensity of a pixel associated with the texel, the determining including,

accessing the value associated with the texel; and

applying the value to a quantity representing a light source component.

17. The method of claim 16, wherein the method operation of associating a value corresponding to a multi-directional signal with a texel of the texture map includes, computing a function representing reflected light over a sphere of incoming light relative to a point associated with the texel.

18. The method of claim 16, wherein the method operation of associating a value corresponding to a multi-directional signal with a texel of the texture map includes, inserting the value with data corresponding to the texel.

19. The method of claim 16, further comprising:  
displaying the pixel having the intensity.

20. The method of claim 17, wherein the method operation of applying the value to a quantity representing a light source component includes, projecting both the function representing reflected light and a function deriving the light source component into spherical harmonic coefficients; and defining an integral of a product of the function representing reflected light and the function deriving the light source component.

21. The method of claim 20 wherein the integral is equal to a dot product of respective coefficients of each of the functions.

22. A computer readable medium having program instructions for rendering an image with high resolution lighting characteristics, comprising:

program instructions for accessing a lighting characteristic value associated with a texel of a texture map associated with the image;

program instructions for associating a coordinate space of the texture map with a display screen coordinate space; and

program instructions for applying the lighting characteristic value to a corresponding pixel for presentation on the display screen.

23. The computer readable medium of claim 22, wherein the program instructions for associating a coordinate space of the texture map with a display screen coordinate space includes,

program instructions for mapping the coordinate space of the texture map with the display screen coordinate space.

24. The computer readable medium of claim 22, wherein the program instructions for applying the lighting characteristic value to a corresponding pixel for presentation on the display screen includes,

program instructions for multiplying coefficients of the lighting characteristic with coefficients representing incoming light.

25. The computer readable medium of claim 22, wherein the lighting characteristic is derived from a spherical harmonics based function.

26. A computer readable medium having program instructions for incorporating lighting characteristics of an image of an object into a texture map, comprising:

- program instructions for defining a texture map associated with the image;
- program instructions for determining a lighting characteristic associated with a texel of the texture map; and
- program instructions for associating the texel with the lighting characteristic.

27. The computer readable medium of claim 26, wherein the program instructions for determining a lighting characteristic associated with a texel of the texture map includes,

- program instructions for identifying a point on the image; and
- program instructions for calculating a coefficient representing the lighting characteristic through the application of a spherical basis function.

28. The computer readable medium of claim 26, wherein the lighting characteristic includes both self shadowing and self interreflection components.

29. The computer readable medium of claim 26, wherein the program instructions for determining a lighting characteristic associated with a texel of the texture map includes,

program instructions for calculating the lighting characteristic in a manner such that an intensity of the lighting characteristic does not fluctuate when a light source is moved.

30. The computer readable medium of claim 26, wherein the lighting characteristic is derived from a transfer function.

31. The computer readable medium of claim 30, wherein the transfer function is configured to determine a value representing reflected light from a surface of the image.

32. A computing device, comprising:

a memory capable of storing data representing a texture map associated with an image, the texture map containing a texel, the texel associated with data describing a light field for a point within the texel according to a basis function;

logic for mapping the texel to a pixel associated with a display screen in communication with the computing device;

logic for accessing the data describing the light field;

logic for determining an intensity associated with the pixel based upon the data describing the light field; and

logic for enabling presentation of the intensity of the pixel on the display screen.

33. The computing device of claim 32, wherein the computing device is one of a video game console and a server.

34. The computing device of claim 32, further comprising:  
a display screen in communication with the computing device.

35. The computing device of claim 32, wherein the logic for determining an intensity associated with the pixel based upon the data describing the light field includes,  
logic for determining an incoming illumination value; and  
logic for combining the incoming illumination value with the data describing the light field.

36. An integrated circuit, comprising:  
a memory capable of storing data corresponding to a self shadow and self interreflection lighting characteristics associated with an image;  
circuitry for accessing the data;  
circuitry for determining an intensity associated with a pixel based upon a product of the data and an illumination value; and  
circuitry for enabling presentation of the intensity of the pixel on the display screen.

37. The integrated circuit of claim 36, wherein the image is associated with a video game.

38. The integrated circuit of claim 36, wherein the integrated circuit is incorporated into a video game console.

39. The integrated circuit of claim 36, wherein the data is associated with a texel of a texture map stored in memory.

40. The integrated circuit of claim 39, wherein a lookup table maps the texel to the pixel.